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Impact of Flooding on the Health of Coastal Fishing Folks in Epe Division of Lagos State, Nigeria

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ABSTRACT There have been predictions that the impact of global warming would put several inhabitants of coasts at serious risk of flooding. This paper analyzed the impact of flooding on coastal fishing folks in Lagos state. The data were collected with simple random sampling and analyzed with simple descriptive statistics and Probit regression. Results showed that average fishing experience was about 10 years and 14.89 percent had their water contaminated during flooding. Also, 27.66 percent spent more on health during flooding while 27.66 percent, 25.53 percent and 23.40 percent reported that diarrhea, typhoid fever and cholera became more prominent after flooding. Also, 40.43 percent indicated that members between 40<65 years were mostly affected by flooding. The Probit regression results revealed that parameters of water contaminated during flooding, single marital status, number of female, income, fishing experience, cholera incidence and climate change affects 40<65 years most increased likelihoods of spending more on health during flooding, while male household headship, diarrhea incidence and climate change affects 19<40 years most reduced it. It was concluded that intervention preparedness to address water needs of households will help in reducing the health impacts of flooding.

INTRODUCTION

Nigeria had experienced several emergency situations that resulted from environmental disasters with some being natural and a number of others were caused by human activities. The natural episodes of environmental hazards include tropical storms, land erosion, windstorms, floods, drought, desertification, human diseases, coastal erosion, livestock diseases, crop pests and diseases, wildfire, harmattan haze and landslides. The major man-made hazards include civil strife (conflicts), traffic accidents on road, water and air and technological episodes such as oil spills, hazardous wastes dumping as well as industrial accidents. Flooding as a natural disaster affects at least 20% of the Nigeria's population. This often poses threats to physical infrastructures, including residential buildings, roads, bridges, port installations among others. In many instances, flooding had destroyed farmlands, crops, livestock and aquaculture farms with consequences that cannot be repaired. Flooding and its twin problem of erosion cause losses that run into billions of naira annually. A good case study was the loss of 560 farmlands in Taraba state or that of Angalaweigbene community where despite some preventive mechanisms that are in place, livelihoods were lost (Ayo-Lawal 2008). Climatic change impacts are believed to increase frequency of occurrence of floods (Ayo-Lawal 2008; Osman-Elasha et al. 2007)). These call for urgent mitigation through emergency preparedness mechanisms and involvement of relevant stakeholders (International Panel on Climate Change [IPCC] 2001; Nhemachena and Hassan 2007).

The Second Assessment Report of the IPCC projected global warming of between 1-3.5°C. This has the potential to upset ocean currents and fisheries thereby posing a threat to livelihoods and food security. Increases in temperature are accompanied by an average sea level rise of 15-95cm. Although the values of sea level rise may seem small, inundation effects of sea level rise show that a sea level rise of 0.3m (1ft) could cause an inundation of more than 35m (100ft) according to the CSI Special report. The implication of this for Nigeria is horrendous because Lagos alone has 15 million inhabitants at sea level (IPCC 2001). A great majority of the inhabitants of coastal areas are in rural areas where fishing is the primary means of livelihoods.

Though there are no sufficient data on the frequency of disasters due to climate change, Jepma et al. (1998) estimated that with a 70cm sea level rise, the number of people at risk of annual flooding could increase from 46 million to 90 million. This is worrisome because the geographical location of Lagos as a coastal city

makes it highly vulnerable to flooding. Cases of flooding that resulted in several economic losses are annually reported. In some instances, the nature of flooding in Nigeria could be flash floods (river flooding) after torrential rains, dam bursts which follow flash floods and urban flooding of low-lying areas with poor surface drainage as well as coastal flooding. The rainy season is marked by widespread phenomenon of flooding experienced due to heavy torrential rains or storm surge exacerbated by the low lying (coastal) topography, vulnerable soil characteristics, and intense wave and tidal action (UNESCO/CSI 2000). Urbanization and increase in population pressure with their attendant problems of poor land use from alterations and blockages of water channels constitute the human induced causes of flooding. In some instances, refuses are dumped or buildings are erected along water channels. Also, subsidence resulting from extraction of oil, gas, minerals/ores as well as underground water has been closely linked to flooding as evidenced by the famous city of Venice (Kerski and Ross 2005).

Developing countries are already under pressure from rapid population growth with its attendant problems of which resource depletion is but one. The population of Nigeria is growing at a fast rate of 4-5% resulting in more people living in high risk areas. Agriculture as a sector provides basic livelihood services to the poor because it is labour friendly and most farmers prefer to use the fertile floodplains or river banks for proximity to water. This buttresses the fact that more than half of the world's population as well as most of the fertile lands and (urban) dwellings are located in coastal and delta regions, where the changes outlined above will occur (IFRC 2000). The impact on physical infrastructure and human livelihoods will therefore be numerous and widespread.

Flooding is expected to bring about some losses in biodiversity. In some instances, human life and livelihoods are threatened. The health implications of flooding presupposes some emergencies resulting from outbreak of diseases like cholera, dysentery, malaria and yellow fever and increase the chances of famine in areas with inadequate coping systems (Blaikie 1994). Literature maintains that areas where malaria is currently endemic could experience intensified transmission because flooding provides breeding ground for mosquitoes. Increases in non-vector-borne infectious diseases, such as salmonellosis, cholera and giardiasis, also could occur as a result of elevated temperatures and increased flooding. This means that a great obstacle stands in the way of achievement of the millennium development goals because malaria is endemic in this part of Africa and translates into drastically reduced food production leading to food insecurity and all its attendant problems. In the event of flooding, households that depend on well water may have it contaminated. Therefore, there can be outbreak of water-borne diseases.

Some of the flood specific adaptation responses include: building sturdier houses raised above ground level, improved control of river siltation and more regular dredging of rivers. The situation among fishing communities in Lagos is pathetic because many of them live on water inside houses that have been raised on poles. Therefore, definite steps to ensure adequate education amongst fishing folks about signs to watch out for in event of pending flooding and proactive efforts to eliminate disease causing organisms breeding sites, and early warnings can have significant impact on people's lives. Recent efforts by the government include digging of new wells and boreholes in response to salt water intrusion, delineation of flood and erosion hazard areas, establishment of sea-level observing systems, prevention of sand and gravel mining for building purposes, and afforestation of sand dunes. Sea level observation is currently being carried out by NIOMR (UNESCO/CSI 2000) and embankments are in place in Lagos Marina using sheet pilings and moles. This paper assessed the health impact of flooding among fishing folks in Lagos state. The objective is to determine the factors explaining condition of spending more on households' health after flooding. In the remaining parts of the paper, I have presented the materials and methods, results and discussions and conclusion.

MATERIAL AND METHODS

Area of Study

The study was carried out in Epe which is a coastal town in Lagos state demarcated by a long range of hills into equal parts. The Epe division lies 89 km northeast of Lagos is divided into two local government areas: Epe (the sec-

retariat at Itamarun) and Ibeju-Lekki which has a long sandy beach. Based on 2006 National Population Census, Epe local government area has a total population of 323,634 people of which 153,360 were males (National Bureau of Statistics 2009). Most of the inhabitants of the division engaged in fishing and farming activities for their livelihood though the fishing is seasonal, synchronized to life cycle of the fish. The land is highly endowed with forest wood and crops grown include rice, coconut, pineapple, cassava, cocoa, palm tree, banana or plantain, maize, vegetables and ginger favoring conditions. Silica sands, fish, reptiles, shrimps and bitumen are also extractable in the area.

Data and Sampling Procedures

The data used for this study were collected from primary and secondary sources. The secondary data were collated and collected from various sources such as newspapers, books, journals, that is, libraries and internet searches as well as visiting relevant bodies such as the secretariats, Nigerian Institute of Oceanography and Marine Research (NIOMR) in Victoria Island, Lagos, etc. Primary data, on the other hand were collected via personal interviews aided by structured questionnaires and observations. The simple random technique was applied in this study. The respondents, that is, fishermen were randomly selected. The selection of communities in Epe was based on degree of fishing activities and proximity to water source. The communities visited included Owode and Olowo market. These were chosen because of high degree of fishery activity. General survey was conducted of the communities to note the physical state of the environment during in depth interviews.

Analytical Model

The Probit Model

Factors influencing incurring of more cost on health during flooding were analyzed using Probit model. This was due to the dichotomous nature of the dependent variable which was 1 if yes and 0 otherwise. The model can be stated as:

$$Y_i = \eta + \beta_i \sum_{i=1}^{k} Z_i + e_i \quad \text{.....1}$$

where Y_i is the binary dependent variable indicating if household spends more on health during flooding (yes =1; 0 otherwise). η and β_i are the estimated parameters, k is the number of variables and e_i is the error term. The independent variables (Z_i) were specified as water contaminated during flooding (yes = 1, 0 otherwise), sex of household heads (male =1, 0 otherwise), age of household heads, single marital status (yes =1, 0 otherwise), number of males, number of females, formal education (yes =1, 0 otherwise), fishing as primary occupation (yes =1, 0 otherwise), monthly income (₦ 000), spouse works (yes =1, 0 otherwise), fishing experience, membership of association (yes =1, 0 otherwise), diarrhea during flooding (yes =1, 0 otherwise), typhoid during flooding (yes =1, 0 otherwise), cholera during flooding (yes =1, 0 otherwise), influenza during flooding (yes =1, 0 otherwise), climate change affects children <10 years most (yes =1, 0 otherwise), climate change affects 10<19 years most (yes =1, 0 otherwise), climate change affects 19<40 years most (yes =1, 0 otherwise) and climate change affects 40<65 years most (yes =1, 0 otherwise).

RESULTS AND DISCUSSION

Socio-economic Profiles of Households

Table 1 shows the socio-economic characteristics of the fishing folks. It reveals that 86.17 percent of them were male. Male dominance as household heads is expected in the fishing community because tradition requires this. Average age of household head is 36.41, with standard deviation of 9.95. The youngest person was 20 year old, while the oldest was 67 years. Also, 24.47 percent of the fishing folks were single, while the rest were either married or divorced. Average household size was 6.14, with standard deviation of 2.91. About 75 percent of the fishing folks had formal education by attending at least primary school. Majority of the respondents (73.40 percent) had fishing as their primary occupation. Some few others were into other primary occupation just going for fishing as a hobby. Average income was ₦29803.19 with standard deviation of 63509.96 because some of the households did not provide information on their income. However, 56.38 percent of the fishing folks indicated that their wives were working, while average fishing experience was about 10 years. Also, 47.51 percent were members of some associations where credit or other common values in life are shared.

Table 1: Socio-economic characteristics of respondents

Variable	*Mean*	*Std. dev.*	*Min*	*Max*
Sex of household heads (Male =1, 0 otherwise)	.8617021	.3461342	0	1
Age of household heads	36.41489	9.947896	20	67
Single marital status (yes =1, 0 otherwise)	.2446809	.4310457	0	1
Household size	6.138298	2.912635	2	17
Number of males	2.234043	2.146633	0	8
Number of female	1.882979	1.866429	0	8
Formal education (yes =1, 0 otherwise)	.7553191	.4310457	0	1
Fishing as primary occupation (yes =1, 0 otherwise)	.7340426	.4430215	0	1
Income (₦)	29803.19	63509.96	0	350000
Spouse works (yes =1, 0 otherwise)	.5638298	.4972332	0	1
Fishing experience	9.638298	11.22912	0	50
Membership of association (yes =1, 0 otherwise)	.6595745	.4751176	0	1

Flooding and Households' Health

The distribution of health problems that were reported by fishing folks is presented in Table 2. It revealed that 14.89 percent had their water contaminated, while 27.66 percent spent more on health during flooding. Water contamination cannot be avoided during flooding because majority of the households had well water. In the event of flooding, contaminated water will seep inside the well, thereby polluting it. If such water is used for food preparation with adequate treatment, there is likelihood of being infected with water-borne diseases. It was reported by 27.66 percent of the fishing folks that diarrhoea became more prominent during flooding. Also, typhoid fever was reported by 25.53 percent. Also, 23.40 percent indicated that cholera could be a health problem during flooding, while 31.91 percent reported influenza.

Table 2: Reported health challenges during flooding

Variables	*Mean*
Water contaminated during flooding	14.89
Spend more on health during flooding	27.66
Diarrhea during flooding	27.66
Typhoid during flooding	25.53
Cholera during flooding	23.40
Influenza during flooding	31.91
Climate change affects children <10 years most	29.79
Climate change affects 10<19 years most	32.98
Climate change affects 19<40 years most	22.34
Climate change affects 40<65 years most	40.43

Table 2 also shows the age group of household member that were mostly affected by flooding. It reveals that 29.79 percent indicated that climate change children that are less than 10 years are mostly affected by flooding, while 32.98 percent noted that it affected those in the age range of 10<19 years. Also, 22.34 percent indicated that household members within the age of 19<40 years were mostly affected and 40.43 percent indicated that members between 40<65 years were mostly affected.

Flooding and Expenditure on Health

Table 3 shows the results of the Probit regression and marginal effects analyses. It shows that the model produced a good fit for the data, given the statistical significance of the likelihood ratio Chi Square ($p<0.05$). The parameters of water contaminated during flooding (1.5354) is statistically significant ($p<0.01$). Its marginal parameter implies that those who reported water contamination as a result of flooding had 18.20 percent more likelihood of spending on health during flooding ($p<0.05$). The parameter of sex of household size (-1.6694) is statistical parameter did not show statistical significance ($p>0.10$). However, the marginal parameter implies that male headed households had 27.78 percent less likelihoods of reporting more health expenditure during flooding than their female counterparts.

The parameter of single marital status (2.0785) showed statistical significance ($p<0.01$), while the marginal parameter is also statistically significant ($p<0.10$). The marginal parameter indicates that fishing folks that were not married (single) had 33.13 percent more likelihood of reporting increase in health expenditure than those who were married. The number of female parameter (0.2770) is statistically significant ($p<0.05$). Its marginal parameter indicated that a unit in-

Table 3: Probit regression results of factors influencing spending more on health during flooding

Variables	*Coefficient*	*z-value*	*Marginal effect*	*z-value*
Water contaminated during flooding	1.5354***	3.03	0.1820**	2.05
Sex of household heads (Male =1, 0 otherwise)	-1.6694**	-2.41	-0.2778	-1.54
Age of household heads	-0.0188	-0.65	-0.0010	-0.65
Single marital status (yes =1, 0 otherwise)	2.0785***	2.75	0.3313*	1.86
Number of males	0.2183*	1.64	0.0120	1.26
Number of female	0.2770**	2.02	0.0153*	1.70
Formal education (yes =1, 0 otherwise)	0.2600	0.42	0.0127	0.49
Fishing (yes =1, 0 otherwise)	0.6397	1.15	0.0275	1.32
Income ('000 ₦)	0.0064**	2.30	0.0003	1.60
Spouse works (yes =1, 0 otherwise)	1.5443**	1.96	0.0921*	1.70
Fishing experience	0.0522**	2.43	0.0029*	1.74
Membership of association (yes =1, 0 otherwise)	-0.7712	-1.38	-0.0572	-1.21
Diarrhea during flooding (yes =1, 0 otherwise)	-1.4262**	-2.04	-0.0541	-1.50
Typhoid during flooding (yes =1, 0 otherwise)	0.2878	0.64	0.0184	0.56
Cholera during flooding (yes =1, 0 otherwise)	2.0024**	2.48	0.3175	1.60
Influenza during flooding (yes =1, 0 otherwise)	0.7928	1.62	0.0612	1.04
Climate change affects children <10 years most	-0.8951	-1.50	-0.0381	-1.40
Climate change affects 10<19 years most	-0.1217	-0.26	-0.0065	-0.28
Climate change affects 19<40 years most	-0.9120*	-1.79	-0.0336	-1.35
Climate change affects 40<65 years most	1.0452**	2.13	0.0780	1.43
Constant	-2.8127*	-1.83		
LR Chi square (21)	69.08***			
Pseudo R2	0.4366			
Log likelihood	44.580913			

crease in the number female will increase the likelihood of spending more on health during flooding by 1.53 percent.

Income parameter (0.0064) is also statistically significant ($p<0.05$) and its marginal parameter implies that a thousand naira increase in fishing folks income will lead to 0.3 percent increase in the likelihoods of spending more on health during flooding. The parameter of spouse work (1.5443) is statistically significant ($p<0.05$). The marginal parameter shows that those fishing folks whose spouse worked had 9.21 percent point likelihoods of spending more on health during flooding. Fishing experience parameter (0.0522) is statistically significant ($p<0.05$) with marginal parameter implying that if the years of fishing experience increases by one year, the likelihood of spending more on health during flooding will increase by 0.29 percent.

The parameter of diarrhea incidences during flooding (-1.4262) is statistically significant ($p<0.05$). Its marginal parameter implies that those fishing folks that reported higher incidence of diarrhea during flooding had 5.41 percent less likelihood of spending more on health during flooding. The parameter of cholera incidence during flooding is also statistically significant ($p<0.05$). Its marginal effect parameter implies that those that reported cholera incidence had 31.75 percent more likelihood of spending more on health during flooding. Also, the parameter of climate change affects 19<40 years old (-0.9120) is statistically significant ($p<0.10$). Its marginal parameter indicates that when this age group is mostly affected, the likelihood of spending more on health decreases by 3.36 percent. However, computed parameter (1.0452) for the climate change affects 40<60 years age group is statistically significant ($p<0.05$), and its marginal estimation indicates that for belonging to that age group, likelihood of spending more on health during flooding increased by 7.80 percent.

CONCLUSION

Flooding as an environmental problem affects several economic activities of coastal fishing folks since their livelihoods absolutely depend on fishing. In many instances, the aftermath health implications of flooding often transcend the monetary losses incurred from disruptions to several economic activities. The find-

ings of this study have shown that underground water contamination poses some health threats to some households after flooding. Also, exposure to some environmental risks after flooding often resulted in health challenges in forms of water-borne diseases that made some households' health bills to soar up after flooding. Reported health problems include diarrhoea, typhoid fever, cholera and influenza. Similarly, the health impact of flooding can be explained from the age group of household members mostly affected. This is due to different resilient capacity possessed by different age groups.

Based on the major findings of the study, it is recommended that government's efforts to safeguard outbreak of water borne diseases by supply the people portable water immediately after flooding will help in mitigating the impact of flooding. The researchers found gender disparity in reported health impact of flooding. This presupposes that efforts to set up adequate medium to address the needs of female headed households in a flood prone environment will help to reduce the impact. Also, health provision interventions that would focus on outbreak of water-borne diseases after flooding should be set up. Specific areas of interventions include diarrhea and cholera. Also, such health intervention should also address specific health needs of different age composition of household members.

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